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## (54) Automotive vehicle and head protection device for vehicle occupants

(57) The object is to provide an automotive vehicle and a head protection device including a curtain-type airbag, wherein a pipe inside the airbag does not interfere with any of projecting members on a peripheral side portion of a vehicle ceiling so that the airbag can be easily installed. This object is achieved by a head protection device having a curtain-type airbag (20), a gas distribu-

tion pipe (24), and an inflator (23) for spouting gas into the pipe (24), the head protection device being installed along a side rail (4) of a vehicle body (1). A bracket (30) and the airbag (20) are positioned not to interfere with a belt anchor stalk (18) and a striker mounting bracket (40). To correspond this, the pipe (24) inserted in the airbag (20) is provided with a curved portion (28).

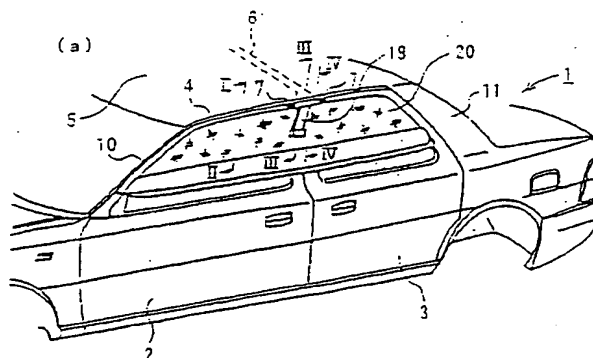
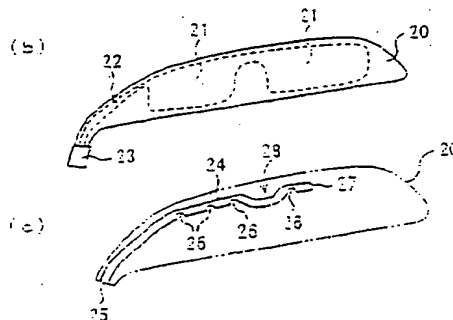


Fig. 1



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## Description

## [Industrial Field of the Invention]

[0001] The present invention relates to an automotive vehicle and a head protection device for vehicle occupants and, more particularly, to a head protection device having a curtain-type airbag which is inflatable along windows of side doors in the event of a side impact or rollover, and the automotive vehicle equipped with the same.

## [Related Art]

[0002] A head protection device having a curtain-type airbag which is inflatable along windows of side doors in the event of a side impact or rollover is known from, for example, WO96/26087. A head protection device is also known in which, for achieving the distribution of gas into an airbag to inflate the airbag, a pipe is arranged in the airbag and the pipe is formed with holes allowing the gas to spout out.

[0003] Seat belt devices for protecting vehicle occupants are well known. In case of a hard-top sedan, i.e. a sedan without B-pillar, in order to install deflective fittings for shoulder webbings for driver and front passenger, belt anchor stalks are suspended from side edge portions of a vehicle ceiling and the deflective fittings are fixed to the belt anchor stalks.

[0004] Japanese Unexamined Patent Publication No. 2000-280746 discloses a automotive vehicle having biparting doors as shown in Fig. 6. That is, a front door 2 and a rear door 3 which open in a biparting manner are disposed at a side of a vehicle body 1. The rear door 3 is hinged at a rear side thereof against the vehicle body 1. The front door 2 and the rear door 3 are adapted so that the rear edge of the front door 2 and the front edge of the rear door 3 are matched to each other.

[0005] The roof of the vehicle body 1 comprises left and right roof side members 4, a roof panel 5 and a reinforcing member (roof cross member) 6 which extend between the roof side members 4.

[0006] The roof side members 4 are provided with strikers 7 for latching the doors 2, 3. Similarly, floor side members are provided with strikers 8 for latching the doors 2, 3. The vehicle body 1 has A-pillars 10 and C-pillars 11, but does not have B-pillars.

## [Problems to be resolved by the Invention]

[0007] In case where a curtain-type airbag with a gas distributing pipe is installed in a hard-top sedan or an automotive vehicle having biparting doors as shown in Fig. 6, since belt anchor stalks for installing deflective fittings, a roof cross member, and/or strikers may be arranged to project from a roof side member, and/or fixing members such as bolts for mounting the strikers or the like may be arranged to project from the roof side mem-

ber, one or more of these projecting members may interfere with the pipe of the airbag.

[0008] It is an object of the present invention to provide a head protection device and an automotive vehicle equipped with such a head protection device having a structure allowing a curtain-type airbag with pipe to be installed to a vehicle having such projecting members.

## [Means to Solve the Problems]

[0009] According to the present invention, this object is achieved by an automotive vehicle as defined in claim 1 and a head protection device as defined in claim 5. The dependent claims define preferred and advantageous embodiments of the present invention. The automotive vehicle of the present invention is equipped with a head protection device along a peripheral side portion of a vehicle ceiling, wherein the head protection device comprises a curtain-type airbag capable of deploying downwardly, a gas source for inflating said airbag, and a pipe arranged inside the airbag for distributing gas from said gas source to chamber(s) inside the airbag, and is characterized by having a projecting member disposed on the peripheral side portion of the vehicle ceiling; and in that said pipe has a curved portion bypassing said projecting member.

[0010] The head protection device for vehicle occupants of the present invention comprises a curtain-type airbag capable of deploying downwardly from a peripheral side portion of a ceiling of an automotive vehicle, a gas source for inflating the airbag, and a pipe arranged inside said airbag for distributing gas from said gas source to chamber(s) inside the airbag, and is characterized in that the pipe has a curved portion for bypassing a projecting member disposed on the peripheral side portion of the ceiling of the automotive vehicle.

[0011] In the automotive vehicle and the head protection device as mentioned above, since the pipe has the curved portion, the pipe does not interfere with any projecting member disposed on the peripheral side portion of the ceiling.

[0012] Therefore, the present invention allows a curtain-type airbag to be installed to an automotive vehicle without B-pillars such as a hardtop sedan and an automotive vehicle having biparting doors. For example, even with a roof reinforcing member, belt anchor stalks for installing deflective fittings for seat belts, strikers for biparting doors, and/or fixing members such as brackets and bolts for mounting the strikers, a curtain-type airbag with a pipe can be installed. This increases the degrees of freedom in designing automotive vehicles.

[0013] When the curtain-type airbag is arranged to be positioned at an inner-cabin-side relative to the belt anchor stalk for mounting a deflective fitting, the curtain-type airbag deploys at inner-cabin-side relative to the deflective fitting for a seat belt.

[Brief Explanation of the drawings]

[0014] Fig. 1(a) is a perspective view of an automotive vehicle according to an embodiment of the invention. Fig. 1(b) is a perspective view of a curtain-type airbag, and Fig. 1(c) is a perspective view schematically showing a pipe inside the curtain-type airbag.

[0015] Fig. 2 is a sectional view taken along a line II-II of Fig. 1(a).

[0016] Fig. 3 is a sectional view taken along a line III-III of Fig. 1(a).

[0017] Fig. 4 is a sectional view taken along a line IV-IV of Fig. 1(a).

[0018] Figs. 5(a), 5(b) are views showing the structure of the pipe.

[0019] Fig. 6 is a perspective view of an automotive vehicle having biparting doors.

[Embodiments for carrying out the invention]

[0020] Hereinafter, an embodiment of the present invention will be described with reference to the attached drawings. Fig. 1(a) is a perspective view of an automotive vehicle according to the embodiment (illustrations of upper parts of doors 2, 3 are omitted). Fig. 1(b) is a perspective view of a curtain-type airbag, and Fig. 1(c) is a perspective view schematically showing a pipe inside the curtain-type airbag. Fig. 2, Fig. 3, and Fig. 4 are sectional views taken along lines II-II, III-III, and IV-IV of Fig. 1(a), respectively, and Figs. 5(a), 5(b) are a plan view and a side view showing the details of the pipe.

[0021] The automotive vehicle shown in Fig. 1 has biparting doors just like the automotive vehicle shown in Fig. 6. The automotive vehicle comprises left and right roof side rails 4, 4, a roof panel 5 and a reinforcing member (roof cross member) 6 which extend between the roof side rails 4 and 4. Strikers 7 for the doors 2, 3 are fixed to each roof side rail 4 via a bracket 40 (Fig. 4) and a belt anchor stalk 18 for installing a deflective fitting is fixed to each roof side rail 4. The belt anchor stalk 18 is positioned around the middle in the longitudinal direction of the roof side rail 4.

[0022] Incidentally, a shoulder webbing withdrawn from a seat belt retractor is passed through an opening of the deflective fitting, but not illustrated.

[0023] Also in this embodiment, the vehicle body 1 has A-pillars 10 and C-pillars, but does not have B-pillars.

[0024] A curtain-type airbag 20 is installed along the roof side rail 4 on a side edge of the ceiling in such a manner that the airbag 20 can deploy to extend between the A-pillar 10 and the C-pillar 11.

[0025] The curtain-type airbag 20 according to the embodiment is made by superposing a cabin-side sheet and a window-side sheet and sewing together the sheets to form a main air passage 22 and small chambers 21, 21. The airbag 20 is provided with holes for mounting the airbag 20 to the roof side rail 4, the A-pillar

10, and the C-pillar 11 of the automotive vehicle, but not shown.

[0026] The main air passage 22 is formed to extend along a front portion of the airbag which extends along the A-pillar 10. An upper portion of the main air passage 22 communicates with an upper portion of the front-side small chamber 21. A pipe 24 is inserted to extend through the main air passage 22 and upper portions of the small chambers 21. The pipe 24 is provided with a plurality of gas ports 26. The front end 25 of the pipe 24 is connected to an inflator (gas generator) 23 together with the front end of the airbag 20. Numeral 27 designates an opening at the rear end of the pipe 24.

[0027] The airbag 20 is installed such that the front portion thereof is accommodated along the A-pillar of the automotive vehicle in the folded state and the middle and rear portions thereof are accommodated along the roof side rail 4 and the C-pillar 11 in the folded state.

[0028] The folded airbag 20 is covered by a cover (not shown). The cover is adapted to be torn when the airbag 20 is inflated.

[0029] As shown in Figs. 2, 3, and 4, a mounting member 30 of the airbag 20 is attached to extend along a roof side rail inner 32 composing the roof side rail 4 and is fixed to the roof side rail inner 32 by welding or the like. Brackets 31 attached to the airbag 20 are connected and secured to the mounting member 30.

[0030] A roof seal 35 is fitted to a lower side edge of the roof side rail 4. The ceiling of the vehicle cabin is composed of a headliner 36 extending along the lower surface of the roof panel 5. The airbag 20 is covered by the headliner 36.

[0031] The headliner 36 has a tear line 36a at a peripheral side portion thereof. When the airbag 20 is inflated as illustrated by a two-dot chain line 20' of Fig. 2, the peripheral side portion of the headliner 36 tears along the tear line 36a so as to open downwardly just as shown by numeral 36' of Fig. 2, whereby the airbag 20' deploys along the upper parts of the doors 2, 3.

[0032] As shown in Fig. 3, an upper portion of the belt anchor stalk 18 is fixed to the roof side rail inner 32 by a bolt 38. The bracket 30 and the airbag 20 are positioned at more inner-cabin-side as compared to the bracket and airbag shown in Fig. 2 not to interfere with the belt anchor stalk 18 and the bolt 38.

[0033] As shown in Fig. 4, a striker mounting bracket 40 for mounting the strikers 7 is fixed to the roof side rail inner 32 by a bolt 41. The bracket 30 downwardly extends longer than that shown in Fig. 2 so that the airbag 20 is located at a lower portion than that shown in Fig. 2.

[0034] To correspond to the configurations of the bracket 30 and the airbag 20 structured not to interfere with the belt anchor stalk 18 and the striker mounting bracket 40, the pipe 24 inserted in the airbag 20 is provided with a curved portion 28 as shown in Fig. 5.

[0035] Because of this curved portion 28, the airbag 20 can be installed without interference of the pipe 24 relative to the belt anchor stalk 18, the striker mounting

bracket 40, and the bolts 33, 41.

[0036] Once the automotive vehicle equipped with such a head protection device as described above comes into a side collision or rolls over, the inflator 23 is activated to spout gas into the gas introduction pipe 24. The gas flows into the respective small chambers 21 through the gas ports 26 and the opening 27 at the rear end of the pipe 24, thereby inflating the small chambers 21. Accordingly, the airbag 20 is inflated downwardly to open the peripheral side portion of the headliner 36 as shown by the numeral 36' in Fig. 2, whereby the airbag 20 deploys along the doors 2, 3. The airbag 20 is tightly stretched between the A-pillar 10 and the C-pillar 11. Therefore, even when an occupant plunges into the airbag 20, the occupant can be securely received by the airbag 20 so that the occupant can be prevented from moving outside from the side window of the vehicle.

[0037] The above embodiment is just illustrative so that the present invention is not limited by the above embodiment. Though the above embodiment relates to an automotive vehicle having biparting doors 2, 3, the present invention can be applied to a hard-top sedan as well. In addition, though the inflator 23 is positioned at the A-pillar 10 side in the above embodiment, the inflator 23 may also be positioned at the C-pillar 11 side.

[0038] Though the airbag 20 has two small chambers 21, the airbag 20 may have only one chamber and may have three or more of small chambers as well.

#### [Effects of the Invention]

[0039] As described above, according to the automotive vehicle and the head protection device of the present invention, a curtain-type airbag can be easily installed without interference of a pipe inside thereof relative to projecting members on a peripheral side portion of a vehicle ceiling.

#### Claims

1. An automotive vehicle (1) equipped with a head protection device along a peripheral side portion of a vehicle ceiling, wherein  
 said head protection device comprises a curtain-type airbag (20) capable of deploying downwardly, a gas source (23) for inflating said airbag (20), and a pipe (24) arranged inside the airbag (20) for distributing gas from said gas source (23) to chamber(s) (21) inside the airbag (20).  
 the automotive vehicle (1) being characterized by having a projecting member (6, 18, 40) disposed on the peripheral side portion of the vehicle ceiling; and in that said pipe (24) has a curved portion (28) bypassing said projecting member (6, 18, 40).

2. An automotive vehicle according to claim 1, being characterized in that said automotive vehicle (1) is an automotive vehicle without B-pillars.
3. An automotive vehicle according to claim 1 or 2, being characterized in that said projecting member is a reinforcing member (6) of a roof (5), a belt anchor stalk (18) for installing a deflative fitting for a seat belt, or a bracket (40) for mounting strikers (7) for biparting doors (2, 3).
4. An automotive vehicle according to any one of claims 1 through 3, being characterized in that said head protection device deploys at inner-cabin-side relative to a deflative fitting of a seat belt.
5. A head protection device for vehicle occupants comprising a curtain-type airbag (20) capable of deploying downwardly from a peripheral side portion of a ceiling of an automotive vehicle (1), a gas source (23) for inflating said airbag (20), and a pipe (24) arranged inside said airbag (20) for distributing gas from said gas source (23) to chamber(s) (21) inside the airbag (20),  
 said head protection device being characterized in that said pipe (24) has a curved portion (28) for bypassing a projecting member (6, 18, 40) disposed on the peripheral side portion of the ceiling of the automotive vehicle (1).

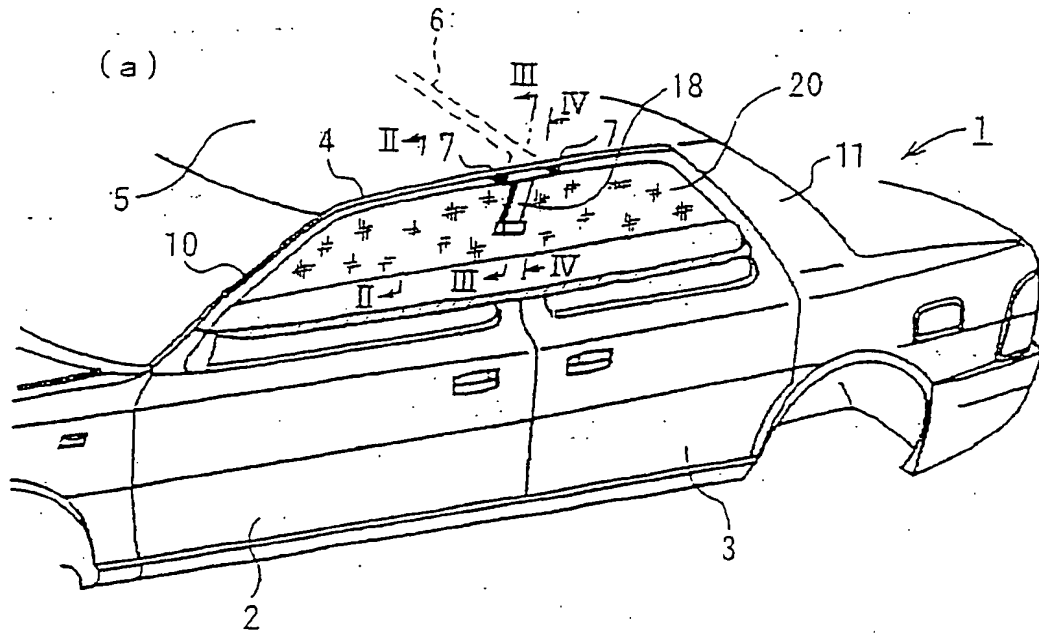
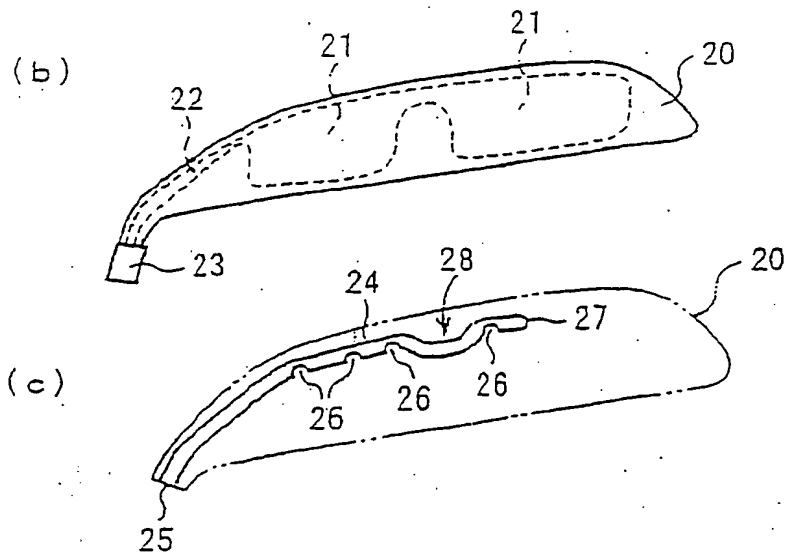
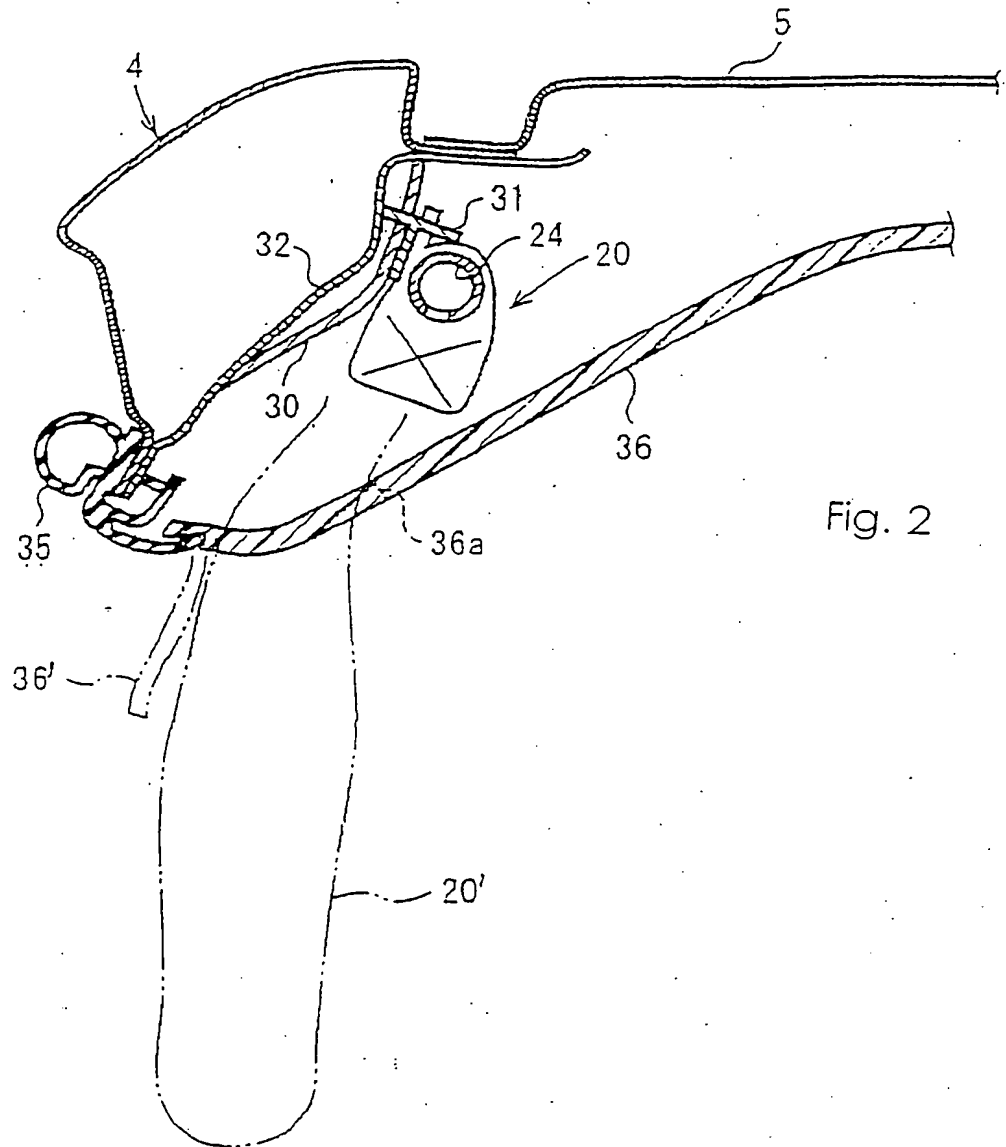


Fig. 1





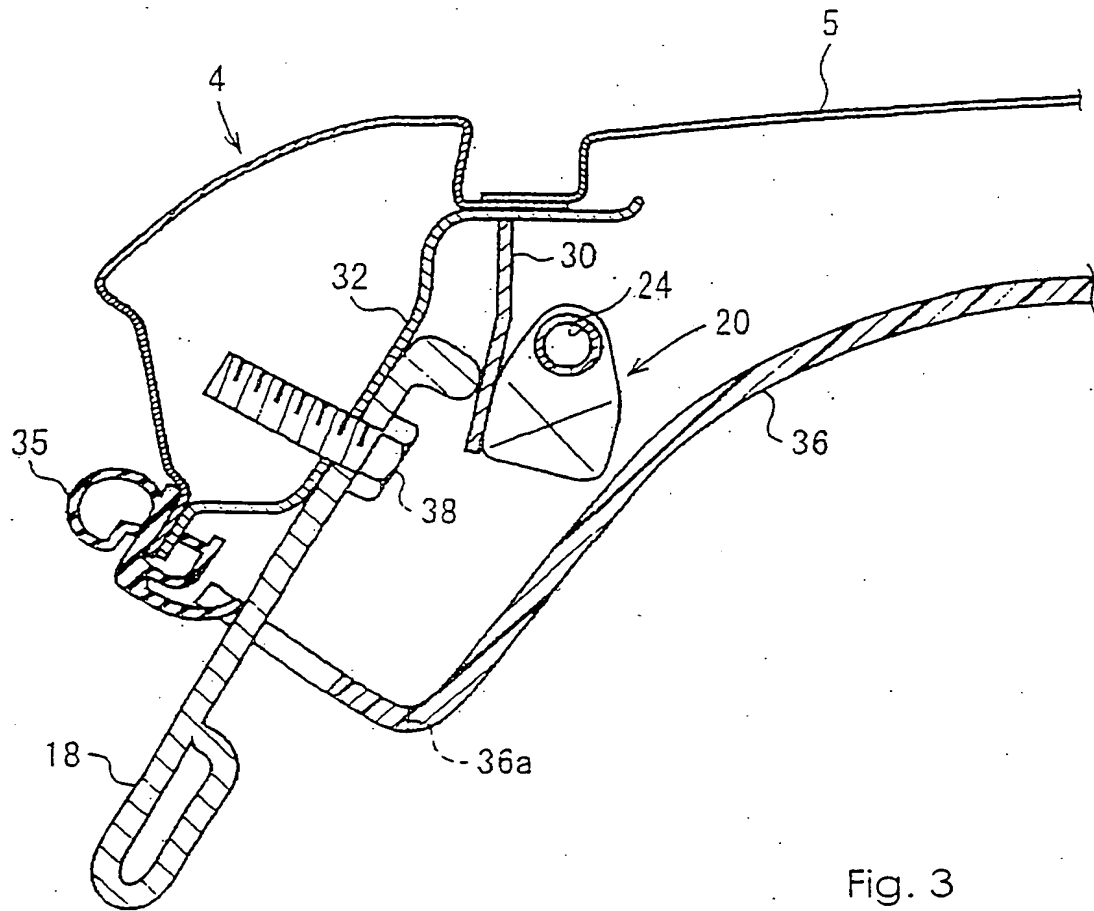


Fig. 3

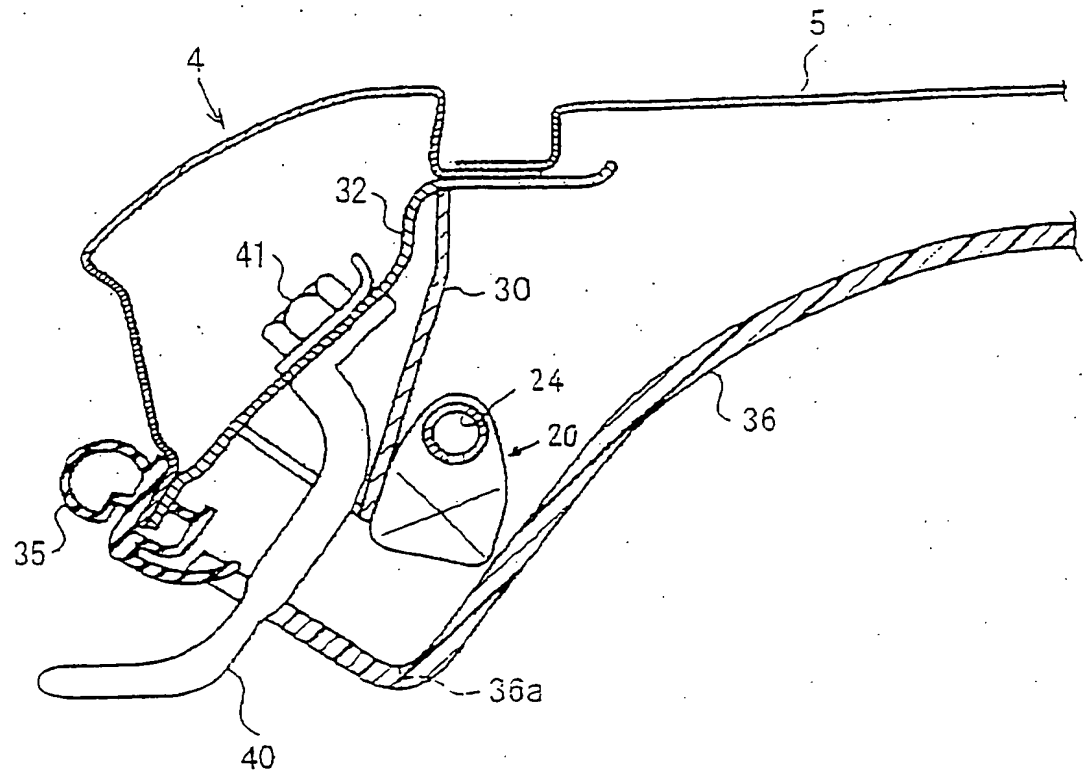


Fig. 4



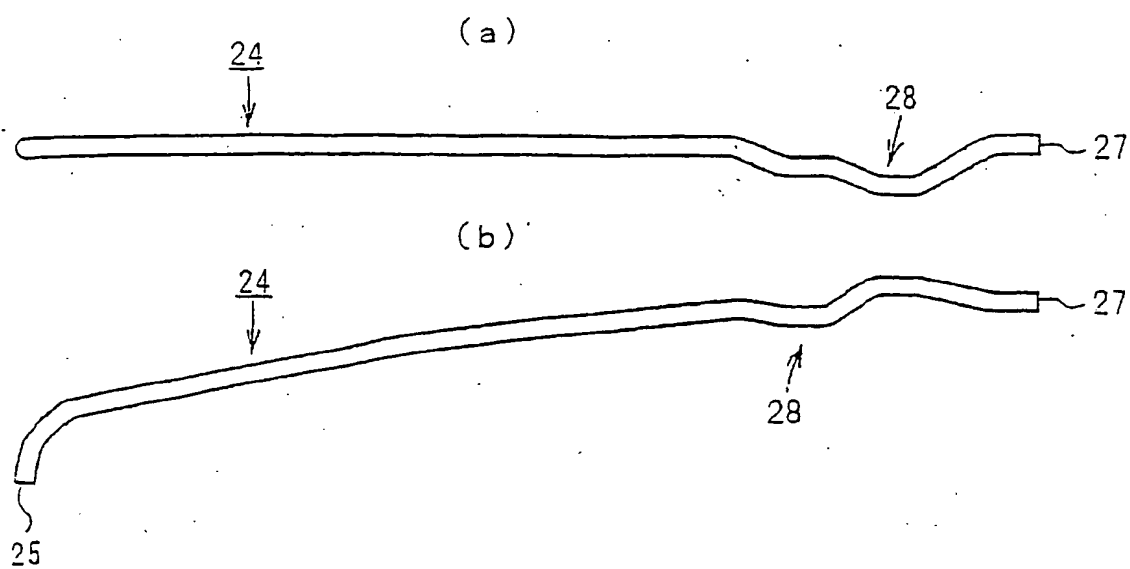


Fig. 5

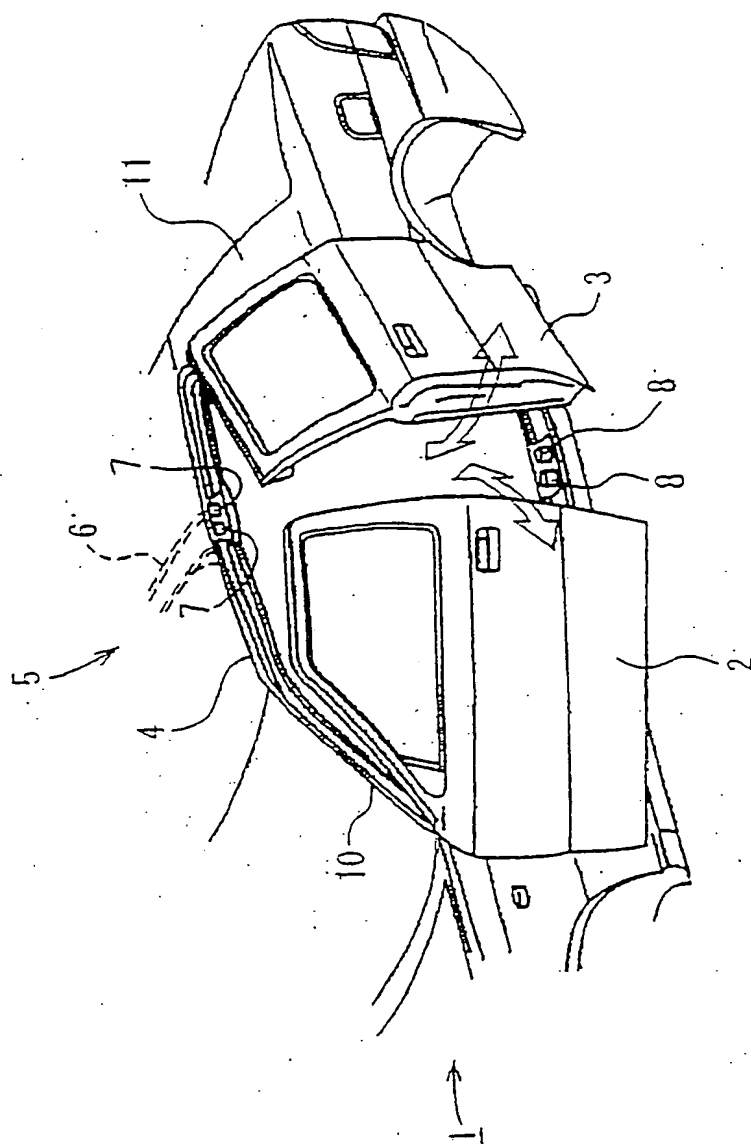


Fig. 6